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DUAL USE OF SCHOOL FALLOUT SHELTER SPACE.

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THIS REPORT DISCUSSES CONSIDERATIONS IN THE USE OF FALLOUT SHELTER SPACE FOR NORMAL SCHOOL ACTIVITIES, INCLUDING THE REQUIREMENTS FOR FALLOUT SHELTERS AND PROBLEMS RELATED TO WINDOWLESS ROOMS. THE PRESENT LACK OF INFORMATION ABOUT PSYCHOLOGICAL PROBLEMS RELATED TO WINDOWLESS ROOMS IS MENTIONED. THE BEST USES FOR WINDOWLESS SPACE ARE NOTED--(1) CAFETERIAS, (2) LARGE-GROUP INSTRUCTION, (3) AUDIO-VISUAL, (4) HEALTH, (5) ADMINISTRATION, AND (6) SHOWER AND LOCKER ROOMS. THE PROS AND CONS OF DUAL USE OF SHELTER SPACE ARE CONSIDERED. THE CONCLUSIONS INDICATE (1) BASIC CLASSIFICATIONS OF SCHOOLS AS TO THEIR SHELTER POTENTIAL, AND (2) IMPORTANT FACTORS TO BE CONSIDERED. ADDITIONAL INFORMATION INCLUDES (1) THE RELATIVE COSTS OF SINGLE USE AND DUAL USE FALLOUT SHELTERS IN SCHOOLS FROM AN ACTUAL CASE STUDY, (2) A LISTING OF SCHOOLS WITH DUAL USE OF FALLOUT SHELTER AREAS AND SCHOOLS WITH WINDOWLESS CLASSROOMS, AND (3) A LETTER DESCRIBING SCHOOL AID FOR FALLOUT SHELTER CONSTRUCTION. (MM)

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DUAL USE OF SCHOOL FALLOUT SHELTER SPACE

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

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Albany, New York

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INTRODUCTION

Schools share the responsibility of considering the provision of fallout shelters with all other public and private construction which is so located and constructed as to offer potential shelter space for people in their vicinity. Since this is so, it is natural to ask: "If fallout shelters are provided, what everyday use can be made of this space which will help bear the cost?"

In lieu of actual experience on the subject, a committee of educators, architects and engineers was convened to explore the question. The meeting provided valuable information about the pros and cons of the dual use of shelter space as seen by the professions represented. It should be emphasized that whatever conclusions or opinions which may be stated in this pamphlet are those of the Educational Facilities Planning Division and not necessarily those of the committee.

The reader should also be aware of the fact that these are statements of first thoughts in a relatively new area, subject to gradual change. One should, therefore, seek the latest authoritative information and evaluate it in the light of the principles expressed in these pages.

It has been assumed that the reader is familiar with such basic facts as what fallout is and how one can protect against its effects. Those few who may not be so prepared are referred to two Department publications and one by the Office of Civil Defense which have been generally distributed to New York State schools:

1) A Guide to Fallout Protection for New York State Schools
2) Nuclear Survival - A Resource Handbook
3) New Buildings with Fallout Protection - TR 27

The manuscript for this pamphlet was prepared by John Sayers, Architect in the Division of Educational Facilities Planning. The committee which gave so generously of its time and talents to the discussion of the problem was composed of the following people:

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DUAL USE OF FALLOUT SHELTER SPACE

I Defining the Problem and Method of Evaluation

What is meant by dual use of fallout shelter space?

Essentially, it is meant to be everyday single use of a space which can, if necessary, serve as a fallout shelter. The only visible evidence of the fact that the space can serve this secondary function would be the shielded entrances and the lack of windows. The additional mass in the walls and overhead will not be apparent to the occupants. Aside from the dual use areas, some storage space, toilet areas and a mechanical room will have to be provided.

If only the proper shielding is provided, it does not matter where the space is located, above or below grade level, in the school building itself or in a detached fallout shelter structure.

As with all spaces of pupil occupancy, dual use space, wherever located, must meet specified safety and health requirements.

How did the problem arise?

In past years the construction of windowless rooms and/or the location below grade of classrooms, shops, locker rooms, cafeterias and the like was considered undesirable for these principal reasons:

1. The physical environment of basement or windowless space left much to be desired, given construction materials and methods and mechanical equipment normally used during that period.

2. There was, and still is, some doubt and question as to the psychological effects of windowless areas upon the occupants, especially upon children of elementary school age.

Although (1) above is no longer a problem, some educators and architects feel that too little is known about (2) above to permit indiscriminate placing of educational spaces in a fallout shelter area.

How can the problem be approached?

If we are to consider the school use of space which precludes natural light and ventilation, we must examine these areas to determine:

1. What is the quality of this space as to

   (a) Physical environment
   (b) Psychological environment
   (c) Efficient integration and function with the other school areas

2. What are the best uses to which such space can be put?

3. How much of a saving in cost can be made by combining spaces rather than building them separately?

4. In the light of (1), (2) and (3) above, is dual use of these fallout shelter areas worth considering?

II Considering the Problem

The quality of the space

It is generally conceded that the physical environment can be made comparable (or nearly so) to naturally lighted and ventilated space, whether the windowless space is above or below grade. The theory that windows are required to allow occupants to focus eyes on distant objects to relieve eye strain is now seriously questioned. Most authorities are of the opinion that the possibility of focusing of eyes at distances of from 6 feet to 20 feet is all that is necessary.

Because of the heavier construction and possible below grade spaces, sounds originating outside the classroom would be almost entirely eliminated and, as a consequence, the ventilating system sounds would be more audible. This could be a distracting influence unless properly taken into account in the design of the system.

There is a division of opinion among educators with regard to the intangible effects of the psychological environment of windowless spaces. There is as yet no reliable information either for or against the school use of such spaces based on objective study of this area. An attempt has been made to list in the Appendix, projects which may eventually produce authoritative conclusions on this area.

Any type of physical environment required by an educational function can be provided by the architect and engineer, at a price. There is a possibility of compensating for the lack of windows through quality of lighting, use of murals or perspective principles and the like.

Whether or not the dual-use space might be utilized efficiently in conjunction with other school areas would be a very important consideration in the final analysis.

The best uses of windowless space (either above or below ground)

The most suitable spaces may well be those for activities requiring intensive concentration on the work at hand, such as language laboratories or hand crafting and other activities of a creative nature. Other areas where students and teachers would be required to spend only a limited amount of time, such as audio-visual uses, large group instruction areas, cafeterias, locker rooms, would be reasonably satisfactory.

The Educational Facilities Planning Division's list of uses most suitable for windowless spaces is as follows:

Cafeterias
Large-group instruction
Audio-visual
Health
Administration
Shower and locker rooms

Present experience indicates that in a plan where kitchen and cafeteria are on different floors, the handling of prepared food is a problem. Presumably, a kitchen and cafeteria at the same level below grade would be more satisfactory, even though it means a more difficult supply problem to the kitchen.

With regard to separate shelter structures, much would depend on the configuration of the space and its proximity to the school. One or more long, narrow structures may have only limited possibilities as dual use space, particularly because of room shapes which result and the exit requirements which apply for normal school use. Having to provide normal toilet and other service facilities to these areas may defeat any potential economies which might accrue otherwise.

Such uses as for field house in connection with athletic fields, storage for grounds equipment and inclement weather shelter area, all would be good. It would seem, though, that for an occasional use only, where large groups of people congregate, the need for mechanical ventilation at those times must be recognized, and, unless it can be provided in a foolproof manner, a dangerous situation could result.

There may occasionally be situations where regular school facilities plus a single use fallout shelter space can be achieved for less money than making dual use of the fallout shelter area. Looking to the time when shelter space may no longer be necessary,

some suitable community or school use of these shelter spaces would be desirable. A community may have need for a museum or art gallery, a library or other community facility.

The Pro and Con of Dual Use Fallout Shelter Space

In almost every instance, there appears to be enough other building space available to locate in the shelter area without resorting to the placing of classrooms there.

This question was asked of a group of school administrators, "Would a saving of about $50 per pupil sheltered justify the dual use of shelter space rather than conventional educational space plus single purpose fallout shelters?" The answer in many cases was that such a saving in total construction cost was insignificant in the total picture and would not justify dual use of shelter space. The wealth of the school district would have much to do with justifying dual use or not.

There would seem to be some value, should it be necessary to occupy it as a fallout shelter at some future time, in students being familiar with the fallout shelter area through everyday use. A minority opinion is that the unfamiliar surroundings would have the positive value of novelty.

Because it would receive regular maintenance, dual use of the shelter area could help prevent deterioration of the space.

Below grade space for educational purposes would, in the opinion of some architects and engineers, cost more than comparable space above ground, on the average.

Of all above grade spaces, possibly the corridors could be shielded and utilized most economically for shelter. Corridors and such other space as storage rooms, toilet rooms, teachers rooms, health suites and administration space would provide, in most schools, more than enough space to shelter the school enrollment and staff if properly shielded.

Providing proper shielding over gymnasium or auditorium spaces would cost more than constructing single use fallout shelter space below grade, where that is possible. If it is possible to put usable mass over these areas, the cost might be cut considerably. For instance, if instead of constructing a heavy concrete roof slab over the long spans, an additional floor of educational space was provided, the cost of the heavy structural members could be shared by the dual use shelter space below and the educational space above.

III Conclusions Regarding the Problem

Basic Classifications of Schools as to Their Shelter Potential

EXISTING BUILDINGS

A. 5 - 10% OF THE STATE'S SCHOOLS HAVE SPACE WHICH CAN BE ADAPTED TO SINGLE USE SHELTER WHICH WILL HOUSE ALL OCCUPANTS OF THAT SCHOOL BUILDING.

REMARKS:

These are usually massive, old, multi-story buildings with a basement under the entire building. Sometimes this basement is half out of the ground but the exterior walls are 18 inches or more thick and are, therefore, acceptable radiation barriers. If the overhead floor and roof construction is wood joist type, the protection factor is poor. If of greater mass, such as concrete, the P.F. is good. Chief modifications required would probably be to block up basement windows, possibly increase overhead mass, and provide proper mechanical equipment.

If the enrollment projection indicates a stable future condition, there may be no need for additional school space and single use shelter in the basement makes sense. If additional space for educational purposes will be needed and the space available can be adapted, other factors must be considered such as 2, 3, 4, 6, 7, 8 and 9 in the list which follows entitled "Important Factors to be Considered."

B. 5 - 10% ARE SIMILAR TO TYPE A EXCEPT THAT BASEMENT AND/OR CORRIDOR AREAS ONLY PARTIALLY MEET THE CAPACITY REQUIREMENTS FOR THE FALLOUT SHELTER USE.

REMARKS:

In such a building, above grade corridors and some adjacent rooms may have to have windows blocked up and entrances shielded to make up the deficit in available fallout shelter space. Permissible uses for these modified rooms will have to be determined by referring to the list of acceptable uses proposed by the Educational Facilities Planning Division and reproduced on page 3.

C. 80 - 90% OF ALL EXISTING PUBLIC SCHOOL BUILDINGS IN NEW YORK STATE HAVE NO REASONABLE POSSIBILITY OF ADAPTING A SIGNIFICANT AMOUNT OF SPACE TO FALLOUT SHELTER USE. THE MAJORITY OF THESE ARE ONE OR TWO-STORY, LIGHTLY CONSTRUCTED, SLAB ON GRADE BUILDINGS.

REMARKS:

If fallout shelter space is to be provided, it will have to be incorporated in a proposed new addition, in a separate fallout shelter structure or a combination of these two. It could be either single or dual use, depending on other factors.

NEW BUILDINGS AND ADDITIONS

D. THOSE WITH FAVORABLE SITE CONDITIONS (DRY AND EASILY EXCAVATED).

REMARKS:

It must be decided whether to put single or dual use shelter under or in the new building or addition or to erect shelter structures on the school site which may or may not have a dual use.

E. THOSE WITH POOR SITE CONDITIONS (WET AND/OR ROCKY).

REMARKS:

It must be decided whether to build dual use space above grade or erect above grade or partially buried single or dual use structures on the site.

F. THOSE CONTEMPLATING ADDITIONS TOO SMALL TO PROVIDE ALL SHELTER NECESSARY.

REMARKS:

It may be necessary to place some or all needed shelter space in shelter structures on the site, either single or dual use.

Important Factors to be Considered

	Applicable to: Existing Building	Applicable to: New Building
1. WHAT PROTECTION FACTOR CAN BE ACHIEVED IN EXISTING SPACE WITH A REASONABLE EXPENDITURE OF MONEY? REMARKS: Usually, if overhead shielding is inadequate, it will be too complicated and expensive to add the additional mass required.	X	
2. HOW MANY PEOPLE CAN BE SHELTERED AND WHAT PERCENTAGE IS THAT OF THE NUMBER WHICH MUST BE SHELTERED NOW AND UNDER FUTURE CONDITIONS? REMARKS: If the percentage is too small, it may be best to provide all the shelter space in a separate shelter structure which may or may not have a dual use.	X	X
3. WHAT IS THE EXPECTED SERVICEABLE LIFE OF THE BUILDING AND ITS EVENTUAL DISPOSAL? REMARKS: If the building is to be vacated in the near future, possibly nothing should be done to it. If, however, it is of massive construction with good shelter potential, perhaps the whole building could be converted either to school or community shelter use by blocking up windows, etc.	X	
4. WHAT IS THE EXPECTED GROWTH RATE IN ENROLLMENT FOR THE AREA SERVED BY THE SCHOOL? REMARKS: The future provision of fallout shelter must be integrated with shelter plans for the present enrollment. Eventually more shelter	X	X

	Existing Building	New Building
space might be built in additions or as separate structures, or more space in the existing building may eventually have single or dual use.		
5. WHAT TYPE OF EXISTING SPACE IS AVAILABLE?	X	X
REMARKS: If below grade space is high ceilinged and relatively free of pipes, it may be convertible to dual use space. Cramped, crowded space might better be left as single use shelter space. Existing above grade school spaces, if in massively constructed buildings, may possibly be converted to dual use fallout shelter areas by blocking up openings to outside if proper school uses can be made of them.		
6. WHAT TYPE OF EDUCATIONAL SPACE IS NEEDED?	X	X
REMARKS: If space needed is the type permitted in fallout shelter space, dual use is a possibility. Given the limited knowledge we have at present on the effects of windowless environments, it is unlikely that classrooms will be allowed in such spaces except under extreme conditions of hardship.		
7. ARE THERE EXISTING SCHOOL FUNCTIONS SUCH AS ADMINISTRATION, CAFETERIA, ETC., WHICH CAN BE TRANSFERRED TO THE PROPOSED SHELTER AREA AND CAN THE VACATED SPACE BE CONVERTED TO THE TYPES OF SPACES REQUIRED FOR THE EDUCATIONAL PROGRAM?	X	
REMARKS: This possibility must be considered so that the best possible available space is devoted to the educational program.		
8. WHAT IS THE COST OF CONVERTING EXISTING SPACE TO:	X	X
SINGLE USE SHELTER		
DUAL USE SHELTER		

	Existing Building	New Building
9. WHAT IS THE COST OF PROVIDING NEW SPACES FOR:	X	X
NEEDED EDUCATIONAL SPACE		
SINGLE USE SHELTER SPACE		
DUAL USE SHELTER SPACE		

REMARKS: Only the individual school districts can decide the questions of value involved. It may be a matter of balancing the desirability of educational space combined with fall-out shelter against a somewhat greater expenditure for separate conventional educational space and single use fall-out shelter space.

10. ARE THERE SOME NON-SCHOOL USES POSSIBLE FOR THE SHELTER AREA?	X	X

REMARKS: The community may have a need for a library, museum, art gallery or similar facility which might be located in the school fallout shelter area.

Recommendations:

There is little point in debating minor advantages or disadvantages which result from placing certain types of educational activities in fallout shelter spaces. The question is purely one of cost and acceptability of the uses to the school district, the Educational Facilities Planning Division, the educators and civil defense authorities. Whatever use is made of the space, furnishings and equipment must not interfere with the possible use of the space as a fallout shelter.

It is recommended that the most recent authoritative information be sought on the matter before decisions are made. As was pointed out in the introduction, the statements and conclusions included here are largely theoretical, and actual experience with shelter construction over the coming months may modify some of these.

Occasionally, a school administrator expresses the opinion that some loss of control is involved in accepting civil defense aid for school shelters. This fear is unfounded. The application form for such aid states at what times and under what conditions civil defense can inspect the space or take control. Any abuses of the agreement on a local level would be quickly corrected if brought to the attention of the Education Department and the State Civil Defense Commission.

IV The Non-Public School and Public Institutions of Higher Education

One major difference between the public and non-public school is that there are no restrictions upon the placement of classrooms in basement areas or in other areas without a view to the exterior. This will make little difference in the basic fact that the decision will end up being one of relative costs and acceptability.

The proportion of heavily constructed buildings is likely to be greater among the non-public schools and colleges because of the tendency to remain with traditional architectural styles. In these buildings there may be more spaces adaptable to single or dual use fallout shelters than in the public schools.

Some schools have resident students for whom they have 24 hour per day responsibility. In this case, shelters should be located so that they can be occupied on 15 minutes notice, either day or night. Trunk rooms, laundry and game rooms in dormitory buildings may well be placed in a fallout shelter area.

City colleges have the special problem of very large evening school enrollments which must be considered in planning shelter facilities, since no one knows just when an attack might occur.

APPENDIX A

The Relative Costs of Single Use and Dual Use Fallout Shelters in Schools from an Actual Case Study

In early 1962, an opportunity arose to compare the relative costs of schools with single use and partial dual use of fallout shelter areas. Two schools of similar quality, by the same architect, in the same geographic location were bid within a month of each other. One school provided a plain basement fallout shelter space which had no school function. The other provided a cafeteria space of almost 13,000 square feet which could shelter the ultimate school population of 1260 people.

The analysis of the school with single use shelter was done as follows:

1) The bid alternates for shelter work were examined for reasonableness and then subtracted from the total contract costs for the general construction, heating and ventilating, plumbing and electrical work. Each contract amount was then converted to cost per square foot and compared to those on a similar school, which had no fallout shelter, to discover any great discrepancy.

2) The cost of the additional excavation and concrete in the overhead slab, sidewalls, columns, footings and floor was computed at current rates and overhead and profit added in.

3) The alternates of item (1) above and construction costs of item (2) above were added to arrive at the total shelter cost.

The analysis of the school with partial dual use cafeteria was done as follows:

1) Its square foot cost was compared to that of a similar school without a fallout shelter of any kind and found to be lower. It was then safe to assume the same square foot cost for the below grade finished space as for the above grade space.

2) While 12,600 square feet of space is needed to shelter the ultimate school population, to feed this number, a cafeteria and kitchen area of only 5,500-6,000 square feet would be required. Thus

there is an excess of 6,600 square feet of finished space which could be assigned other school functions or be constructed as only single use fallout shelter space.

3) The cost of single use shelter space has already been determined as $9.00 to $9.50 per person for this architect in this area at this time.

4) The cost of the equipment and construction necessary to convert existing finished school space below grade to serve as a fallout shelter also, was determined from alternate bids made on both schools and from inquiries made of various equipment suppliers.

5) The square foot costs determined in (3) and (4) immediately above were applied to the excess square footage needed for fallout shelter only and to the normal sized cafeteria facility, respectively. By combining the costs we arrive at the total cost for partial dual use of about 50%.

6) Finally, a hypothetical school was considered which would have 100% dual use of the shelter facilities below grade. By applying the costs determined in (4) above to the dual use space and the costs of (3) above to the required service and mechanical spaces, the cost of completely dual use shelter space was arrived at.

A careful analysis of these two schools revealed the following cost information in terms of upstate prices:

The single use fallout shelter cost $80-$90 per person sheltered.

The partial dual use fallout shelter cost $60-$65 per person sheltered.

A 100% dual use shelter should cost about $28-$35.

Some of the factors which contribute to variations in cost are:

1) Amount of waterproofing required due to site conditions.

2) Ease of excavation.

3) The size of the motor-generator set provided.

APPENDIX B

Schools with dual use of fallout shelter areas:

New York State

Amsterdam Elementary School, Amsterdam

Burger Junior High School, Henrietta

East Rochester Junior High School, Rochester

Fairport Junior-Senior High School, Fairport

Fyle Elementary School, Henrietta

Hudson Elementary School, Hudson

Ossining Junior High School, Ossining

Watertown Senior High School, Watertown

Webster Central School District, Webster:
DeWitt Road Elementary School
Klem Road Elementary School
State Road Elementary School

William Floyd High School, Shirley, Long Island

Schools with windowless classrooms

Alton, Illinois - has several air conditioned schools which are windowless

Chicago, Illinois - Homewood - Flossmore Community High School with interior rooms

Northfield Township, Illinois - Glenbrook High School - a large two-story compact almost windowless building

Olympia Fields High School in Illinois, is compact and windowless

Hobbs, New Mexico - Highland Junior High School (windowless and air conditioned)

Syracuse, New York - Compact F. Ware Clary Junior High for 800 students - air conditioned and practically windowless

Las Vegas, Nevada - Hydepark Junior High - Compact, air conditioned - nearly windowless

Beaumont, Texas - South Park School District - Compact, windowless and air conditioned

APPENDIX C

THE UNIVERSITY OF THE STATE OF NEW YORK
The State Education Department
Albany

March 1, 1965

Memorandum to: City, Village, District Superintendents; Supervising Principals

From: Walter Crewson, Associate Commissioner of Education

Subject: Fallout Shelter Construction

During the past year a number of school districts have included fallout shelters either in new school construction or in the development of additions to existing buildings. These districts have been reimbursed under the State Civil Defense Aid formula which provides up to $25.00 per pupil and school employee for whom shelter space is planned or one-half the total cost of the shelter, whichever amount is less. Thus it would appear that a school district must pay for at least one-half the cost of the fallout shelter in all cases. This is not so. Districts are also aided on the balance as provided by Section 3602 of the Education Law. For example, the computations for a district with a 60% aid ratio rate would be:

Building cost eligible for aid	$750,000	
Assumed cost of fallout shelter	50,000	
State Civil Defense Aid for shelter	25,000	
Subtracting Civil Defense aid from total building cost -		$750,000
		-25,000
Building aid (60% in this case) is payable on		$725,000

Thus the district would receive 60% of the additional one-half ($25,000) of the shelter cost:

$ 25,000
.60%
$ 15,000